

SECTION 17

RETAINING WALLS

1.17.1 DESIGN CRITERIA

- a. Design for retaining walls shall be in accordance with the AASHTO Specifications For Highway Bridges (With Current Interims) and criteria established in Section 16 of this Manual.
- b. For contracts with long walls or several walls, design and detailing information may be conveniently presented in a panel-by-panel tabulation.
 - 1.) Panels should be identified numerically on the General Plan and Elevation and referred to in the tabulation. Similarly, various types of wall sections, reinforcement patterns, etc. should be detailed once and identified for use in the tabulation.
 - 2.) The tabulation should also indicate footing dimensions for each panel, panel end point elevations and footing elevations.
- c. Details such as the placement and arrangement of non-stress reinforcement on wall stems, key construction, porous fill placement, drainage for back of walls and joint construction are common to all panels and should be presented once in a contract set of plans.
- d. When "stepped" footings are used for long walls, the step should preferably not be greater than the depth of the footings, except that when the footing is on piles, the step may be twice the depth of the footing. A 1:1 slope of the concrete should be provided at each step.
- e. Keyed contraction joints shall be provided in footings. They shall be located under the wall expansion joints.
- f. Drainage shall be provided for all walls including U-Type semi-stub abutments. Weep holes through walls shall not be used where they empty onto pedestrian sidewalks or onto roadways where ponding and freezing could create a safety hazard.
- g. Wing stems ("elephant ears") shall be shown on the plans for U-Type and flared walls in accordance with the details shown on Guide Plate 3.4-5. The stems of walls shall be designed for combined axial load (including dead load of stem and of backfill acting on stem) and bending due to vertical loads and earth pressure.
- h. Designers and detailers should be aware that form work is a substantial part of the construction cost for walls and abutments. Details that permit reuse of forms on as many sections as possible produce economies in the overall construction cost.
- i. When battered cross sections are used, the batter of forms should always remain constant and the width of the wall at the top of the batter should be

wide enough so the form can extend beyond the top of the batter and still have enough room between the front and rear forms to easily place the concrete.

- j. Batters that extend only part way up a wall should be avoided. If partial batters are used, the height of the battered portion should always be made a constant height. If the height of the battered portion is constant with respect to the top of the footing, then the variation in height shall be made up in the upper vertical portion of the wall. This will allow maximum reuse of the battered form.
- k. Curved wingwalls should be avoided wherever possible and should not be battered since the shape of the form must be dish-shaped which is extremely difficult to form.
- l. If it is absolutely necessary to provide a curved wingwall, it is best to place the footing and the wall on chords and curve only the top portion of the wall.
- m. Designers are encouraged to use alternate proprietary retaining wall systems at select project locations. Mechanically Stabilized Earth Walls (MSE) and Prefabricated Modular Walls, instead of the standard cast-in-place reinforced concrete cantilever retaining wall system, should be evaluated for use in a project that involves retaining wall construction.

When alternate proprietary wall systems are identified for use in a project, unless otherwise directed, a design for the cast-in-place cantilever wall system is not required.

For those projects where use of Proprietary Walls is not feasible, a presentation for a cast-in-place reinforced concrete cantilever retaining wall system shall be provided.

Sections 7 and 8 of this Manual may be referred to for guidance in providing Preliminary and Final submissions of proprietary walls.

- 1.) In the design of Prefabricated Modular Walls, when the wall is to be constructed in fills or cuts above the water table, one weep hole and a 600 x 600 mm stone pocket shall be provided behind the front face of each of the lowest exposed units. If necessary, the weep hole may be replaced with a 200 mm perforated corrugated metal pipe and a 600 x 600 mm stone pocket.
- 2.) For Mechanically Stabilized Earth Walls and Prefabricated Modular Walls constructed in cuts below the water table, a 203 mm P.C.M.P. and 600 x 600 mm stone pocket shall be placed parallel to and behind the wall. The area above the stone pocket behind the wall shall be backfilled with I-9 porous fill.
- 3.) For MSE walls supporting roadways that may be chemically deiced, to intercept any flows that may contain the deicing chemicals, an impervious membrane shall be placed below the pavement and just above the first row of reinforcements. The membrane shall be sloped to drain away from the wall facing. Refer to Subsection 520.02 of the Standard Specifications for type of material to be used.

- n. Proprietary wall designs shall be in accordance with the current AASHTO Standard Specifications for Highway Bridges.

As per Subsections 5.2.1.4 and 5.2.1.5 of the AASHTO Standard Specifications for Highway Bridges, the following limitations should be adhered to in the proposed use of alternate proprietary retaining walls:

MSE walls should not be used under the following conditions:

- When utilities other than highway drainage must be constructed within the reinforced zone.
- With galvanized metallic reinforcements exposed to surface or ground water contaminated by acid mine drainage or other industrial pollutants as indicated by low pH and high chlorides and sulfates.
- When floodplain erosion may undermine the reinforced fill zone, or where the depth of scour cannot be reliably determined.

Prefabricated modular systems shall not be used under the following conditions:

- On curves with a radius of less than 240 meters, unless the curve can be substituted by a series of chords.
- When calculated longitudinal differential settlements along the face of the wall are greater than $1/200$.
- Steel modular systems shall not be used where the ground water or surface runoff is acid contaminated or where de-icing spray is anticipated.